
Section 2:

BIOMEDICAL LABS INFORMATION

❑ Biomedical Processes

Biomedical laboratories may have several smaller laboratories within a laboratory. The various subspecialties for different areas of analysis are listed below in the the following table 2.1:

Table 2.1 - Types of Specialities at Biomedical Laboratories

Specialty	Description
Microbiology	Bacteriology, Mycobacteriology, Mycology, Parasitology, Virology
Diagnostic Immunology	Syphilis serology, general immunology
Chemistry	Routine chemistry, endocrinology, toxicology
Hematology	Routine hematology, flow cytometry
Urinalysis	
Pathology	Cytology, histology, electron microscopy
Immunohematology	ABO and D(Rho) testing, compatibility testing, unexpected antibody detection, antibody identification
Reproduction and Transplantation	Transplant immunology, experimental pathology, reproductive biology
Research and Development	Animal Testing

(Adapted from Morbid. Mortal. Weekly Rep., 41(RR-2), 9, 1992.)

❑ Biomedical Wastes of Concern

Biomedical laboratories generate a variety of waste types. Wastes may be infectious, hazardous, radioactive or multihazardous (any combination). Infectious wastes are defined by the Centers for Disease Control, the U.S. Environmental Protection Agency, and the Occupational Safety and Health Administration. In addition, there are state and local regulation governing infectious waste. In New Mexico, the New Mexico Solid Waste Management Regulations define infectious waste. The definition of infectious wastes may vary depending on the regulation or guideline given. The City's Sewer Use and Wastewater Control Ordinance follows the *Guidelines from the Center for Disease Control for "Safe Disposal of Solid Wastes*

from Hospitals". Any wastes with toxic biological contamination not addressed by the CDC guidelines should not be discharged to the sewer system.

Hazardous wastes are regulated by the State of New Mexico through its authority to enforce the federal Resource Conservation and Recovery Act (RCRA) regulations. These regulations cover a variety of areas including waste generation and minimization, treatment, storage transportation and disposal. Wastes may be considered hazardous if they are listed in the regulations or are regulated because of a hazardous characteristic such as ignitability, corrosiveness, reactivity or toxicity.

Radioactive waste discharges are determined by New Mexico Radiation Protection Regulations that are enforced by the State of New Mexico Environment Department. The City of Albuquerque currently is initiating a voluntary Radioactive Discharge Management Program that will include hospitals and laboratories. The City's program is developing best management practices for disposal of radioactive materials that businesses can use.

Heavy Metals

Heavy metals used in laboratories include chromium, copper, mercury, silver, and zinc. Many of these heavy metals are regulated due to their potential toxicity. Metals that enter the wastewater treatment plant are either removed and become part of solids or sludge, or they are discharged into the Rio Grande with the City's effluent. Heavy metals do not biodegrade in the wastewater treatment process. Most if not all of the metals have low limits for aquatic toxicity and can be concentrated by the food chain. The following is a description of certain regulated heavy metals and other materials that may be found in biomedical materials and/or cleaners:

Chromium

Chromium is present in chromic acids used for cleaning glassware and in some laboratory reagents. Waste chromic acid is a hazardous waste if the chromium content exceeds the threshold amount of 5 mg/L. Hexavalent chromium (VI) is more toxic than chromium (III). Chromium (VI) readily crosses biological membranes because it forms strong oxidizing chromate and dichromate ions. (From Safety in the Chemical Laboratory, Journal of Chemical Education). Chromium may last in insoluble form indefinitely and threatens all life in its hexavalent (VI) form. Chromium (VI) poses an extreme threat (Prager, 1995, p.476). The State has set Stream Standards for dissolved chromium for the Rio Grande river.

Copper

Copper may be present in some laboratory reagents used by biomedical laboratories. Copper as a metal is not a threat. Copper as a solubilized salt or as an airborne fume is toxic. Copper is a concentratable heavy metal with low levels for chronic aquatic limits. The State has Stream Standards for irrigation, fisheries, and livestock and wildlife watering for dissolved copper (Prager, 1995, p. 521) for the Rio Grande river.

Mercury

Mercury is found as a compound in biomedical laboratories in some reagents and as a liquid metal in electrical switches, and thermometers. Mercury is highly toxic. Methyl mercury is the organic form of mercury in the environment that bioaccumulates, building up in the muscle tissue of living animals (Terrene, 1995,). The State has set Stream

Standards for total mercury for the Rio Grande river.

Silver

Silver may be found in some laboratory reagents. Silver is toxic to aquatic life with bioaccumulation found only in lower levels of the food chain. The nitrate salt is a soluble salt while chloride and carbonate salts rapidly precipitate. The major water uses threatened are fisheries and potable water supplies (Prager 1995, p. 1037). The City of Albuquerque's EPA permit to discharge to the Rio Grande contains strict limits for the discharge of silver. The EPA sampling method and biomedical method includes all forms of silver: particulate, dissolved or complexed silver.

Zinc

Zinc may be present in some laboratory reagents. Zinc is toxic to aquatic life and for fish has a 0.1 ppm acute hazard threshold level. At chronic levels zinc shows no effects to man and only a low mortality rate has been found among aquatic life (Prager 1995, p. 1037). New Mexico has Stream Standards levels for zinc to protect irrigation, fisheries, livestock and wildlife watering.

Organic Materials

Many organic chemicals and compounds are of concern to the wastewater treatment plant. Chemicals with low flash points, that are flammable, and immiscible in water can pose a serious explosion danger in the sewer system. Other chemicals are of concern because of their toxicity and potential harm to the wastewater treatment plant microbial processes and potential for bypassing treatment processes and making it into the Rio Grande River.

Xylene

Xylene is the most commonly used clearant in histology laboratories. Histological xylene typically contains a mixture of isomers of xylene and ethyl benzene. Repeated exposures have neurotoxic effects to humans. Xylene is a flammable liquid and has negligible solubility in water.

Formaldehyde

Formaldehyde is widely used as a fixative and preservative in biomedical laboratories and as a disinfectant. Formaldehydes' toxicity and health effects have caused OSHA to develop the OSHA Formaldehyde Standard.

Alcohols

Methanol, ethanol and isopropyl alcohol are used in biomedical laboratories for a variety of purposes such as tissue processing and staining. Alcohols are flammable and water soluble.

Cyano Complexes

Cyano complexes may be present in cell lysing solutions or as potassium ferricyanide or potassium ferrocyanide. Unlike free cyanide, ferro- and ferricyanide ions (also known as hexacyanoferrates) have a low level of toxicity. The City's industrial wastewater analysis does not differentiate between complexed cyanide compounds (such as hexacyanoferrates) and free cyanide, but rather combines the two and analyzes for 'total cyanide.' Cyanide wastewaters should not exceed the City's Sewer Use and Wastewater

Control Ordinance limits to be discharged to the sewer system.

Other Solvents & Organic Chemicals

Other solvents used in biomedical laboratories that are of concern include chloroform, acetone, gluteraldehyde, ethylene glycol, isopentane, phenol, picric acid, tetrahydrofuran, toluene, and trichloroethane, among others.